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PATENT SPECIFICATION

DRAWINGS ATTACHED

919,100

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COMPLETE SPECIFICATION

A Method and Apparatus for the Production of an Embossing Tool for Providing Special Surface Finishes for Plastic Materials

ERRATA

SPECIFICATION NO. 919,100

Page 1, In the heading, *for* "Application made in Japan" *read* "Application made in United States of America"

Page 1, line 74, *for* "surface of" *read* "surface with"

Page 2, line 83, *for* "saft" *read* "soft"

Page 2, line 97, *delete* "When"

THE PATENT OFFICE
15th April 1963

DS 73303/1(13)/R.109 200 4/63 PL

soft, fur-like, warm finish. It has also been proposed to coat the surface of a smooth plastics material with a film containing a foaming agent so as to form on the coated surface a film of porous, foamed plastics material having a soft, warm feel. Various other techniques have also been proposed in an effort to cause synthetic materials to simulate natural materials. For the most part, however, the techniques proposed heretofore have not been successful on a commercial scale due not only to the expense involved but, more frequently, also due to the fact that the resulting materials did not satisfactorily simulate the natural material or surface sought to be simulated.

It is one object of this invention to provide a method and apparatus for the production of an embossing tool useful for providing such [illegible] tool provided with a plurality of needle-like piercing members so that the surface of the body is pierced by said members, the positioning of the said surface of the embossing tool relatively to said piercing tool and the arrangement of the piercing members being such that, upon contact of the surface of the piercing tool, only some of the piercing members therein initially pierce the surface, the remainder of the piercing members subsequently piercing the surface, whereby the body is pierced more deeply at those locations on the surface of the body wherein the piercing members first contact said surface and less deeply at those locations on such surface which subsequently come into contact with piercing members.

According to yet a further aspect of the invention, there is provided an embossing

[*Price* 4*s.* 6*d.*]

tool comprising a relatively soft metallic body having a surface pierced by holes extending only part of the way downwardly from said surface into said body, such holes being provided on said surface in a density in the range from about 200 to about 37,500 per square inch and having a depth in the range of about 0.002 to about 0.5 inch and an equivalent diameter at the said surface in the range from about 0.002 to about 0.2 inch.

In order that this invention may more readily be understood, reference will now be made, by way of example, to the accompanying drawings in which:—

Figure 1 is a photomicrograph of a cross-section of natural suede;

Figure 2 is a photomicrograph of a cross-section of a suede-like plastic material prepared using an embossing tool in accordance with this invention;

Figures 3 and 4 are photomicrographs of cross-sections of synthetic plastics materials specially treated and prepared using an embossing tool in accordance with this invention;

Figure 5 is a greatly enlarged, fragmentary, cross-sectional view of an embossing tool according to this invention;

Figure 6 illustrates an apparatus or machine in accordance with this invention useful for the preparation of an embossing tool, such as the type illustrated in Fig. 5 and

Figures 7 and 8 are cross-sectional views of special piercing tools employed in apparatus according to this invention for the preparation of embossing tools useful in the preparation of special finishes on plastics surfaces.

It has been determined that plastics materials simulating or possessing the outward appearance and feel of natural materials, such as suede and fur, can be prepared by pressing the relatively soft surface of a plastics material, such as vinyl resin, into contact with a relatively hard, as compared with the synthetic or plastics material, embossing surface of an embossing tool provided with a plurality of holes extending part of the way into said embossing tool. The pressing or embossing operation is carried out under conditions, usually a combination of heat and pressure, such that, as the relatively soft plastics material is pressed into contact with the embossing surface, the plastics material is caused to flow into the holes provided on the embossing surface to fill these holes substantially completely. After the plastics material has been thus pressed into the holes on the embossing surface, the embossing surface is removed from contact with the resulting embossed plastics material, such as by simply lifting or stripping the embossed material away from the embossing surface. After removal the resulting embossed plastics material now has created on the surface thereof a plurality of separate fibres extending outwardly from the surface thereof and integral with, and made of the same material as, said plastics material. Depending upon the density of holes and the depth and size of the holes on the embossing surface, a great variety of natural-like materials can be produced, ranging from suede-like and fur-like materials useful as wearing apparel to somewhat rough, bristly materials useful as a flooring surface or a decorative surface.

The special surfaces prepared in accordance with the practice of this invention impart a different appearance, touch, feel and other characteristics to the finished article depending upon the size and density of the fibres formed on the surface thereof. For example, to impart a saft, warm, suede-like feel and appearance to a plastics material, such as a sheet of vinyl plastics, the plastics material is treated and embossed so as to form on the surface thereof a very large number of relatively small fibres or fibriles in the manner described hereinabove. The fibres have a length, as measured from the base of the fibre to the end thereof, in the range from about 0.002 to about 0.01 inch, and have a diameter, measured at the base, in the range from about 0.002 to about 0.01 inch, the fibres being present on the embossed surface at a density in the range from about 12000 to about 25000 fibres per square inch. When When a soft plastics material is prepared as described herein having the above fibre characteristics, a synthetic suede-like material is produced.

If other materials, not necessarily suede-like in appearance but more fur-like or bristly in appearance are desired, the fibre length and diameter should be greater, such as a fibre length in the range from about 0.1 to about 0.5 inch and a diameter as measured at the base of the fibre in the range from about 0.05 to about 0.2 inch, the fibre density being in the range from about 200 to about 5000 per square inch.

Referring now to the drawings, Fig. 1 is a photomicrograph of a cross-section of natural suede. It is to be noted, as indicated in Fig. 1, that the surface of the natural suede material illustrated therein is made up of what appears to be matted fibres in a relatively flat position with respect to the underlying body of suede material. These matted fibres give a brushed appearance to the suede material and impart a soft, cushiony feel to the surface thereof. As is known, natural suede presents an attractive, dull, non-lustrous, non-reflecting surface but which tends to show dirt or other extraneous material on the surface thereof very readily and requires constant attention, care and brushing in order to be maintained in a clean, pleasing appearance. Since natural suede material is an animal hide

at the other end. Piano wire has been found to be particularly suitable as a piercing member since, although substantially rigid axially, it is quite flexible and in the event that the piercing member strikes the edge of a hole already formed on the surface of an embossing tool it tends to be readily guided into the hole and makes the hole thus entered deeper rather than marring the side of the hole or forming a new hole on the edge of the previously formed hole.

As indicated in Fig. 6, the embossing tool, which is in the form of a roll 27, shown in the figure in cross-section is cylindrical in shape with the result that, since all the ends of piercing members 24*a* lie in the same plane only certain of the piercing members 24*a* initially pierce the surface of embossing roll 27, the remaining piercing members then subsequently piercing the surface of the embossing roll. As a result the initially formed holes are deeper than the subsequently formed holes.

There is provided within the opening 20*a* of the shaft 20 a star gear 25 which is adapted by suitable means, such as an electric motor, not shown, for rotation therein. A cam follower 26 makes contact with the star gear 25 and follows the periphery or contour of this star gear as the latter is rotated. The follower 26 is carried on a projection or extension 28 of shaft 20 extending axially thereof within the opening 20*a*. The other end of the shaft 20 is positioned within a housing 29 and that portion of the shaft 20 which is within the housing 29 is fitted with a flange 30. Positioned on either side of the flange 30 are springs 31 and 32. Spring 31 is positioned on that side of flange 30 nearer to the piercing tool 22 and is rather a light spring, whereas spring 32 is positioned on the other side of flange 30 and is rather a heavy, strong spring. An adjusting nut 34 is threadedly engaged on an inwardly projecting member 35 carried by a cover plate 36 fixed to housing 29 and serves as adjusting means for adjusting and positioning the spring 32 within housing 29 between flange 30 and the cover plate 36.

In the operation of the apparatus illustrated in Fig. 6, the embossing roll 27 is relatively slowly rotated as star gear 25 is rotated. Since the cam follower 26 bears upon, and is in contact with the star gear 25, this cam follower 26, together with the shaft 20 and the piercing tool 22 carried thereon, is forced backwardly against the spring 32 as the star gear 25 is rotated. Upon continued rotation of the star gear 25 the teeth 25*a* thereof are turned clear of cam follower 26 with the result that shaft 20 is no longer restrained by teeth 25*a* against forward movement under the urging of spring 32. Accordingly, shaft 20 is urged forwardly by spring 32 with the result that the piercing members 24 carried by the piercing tool 22 fixed to the shaft 20 are moved forwardly to contact the surface of the embossing roll 27 to form holes therein. The depth at which the holes are formed within the surface of the embossing roll 27, assuming an embossing roll made of a material having a hardness less than that of the piercing members 24, is dependent upon the energy available from spring 32 when it first causes shaft 20 to move forward. The maximum penetration of the piercing members 24 into the embossing roll 27 is dependent upon the free travel distance between cam follower 26 just as it clears the star gear 25 until it again contacts star gear 25 at the base or root of teeth 25a. Upon continued rotation star gear 25 again moves cam 26 together with shaft 20 backwards against spring 32. Accordingly, rotation of star gear 25 causes the shaft 20 and the piercing tool 22 to move repetitively forwards and backwards. By rotating the embossing roll 27 and star gear 25 as described hereinabove and by moving the embossing roll 27 and piercing tool 22 laterally relatively to one another, the surface of the embossing roll 27 can be completely pierced.

In the practice of the embodiment of this invention illustrated in Fig. 6 a cylindrical embossing roll is employed. When a flat embossing plate is employed it is desirable that the piercing tool 22 be replaced with a piercing tool of the type illustrated in Figs. 7 or 8. In Fig. 7 there is shown a piercing tool 40 provided with piercing members 41, the ends 41*a* of which all lie in an inclined plane, such as a plane inclined with respect to face 40*a* of tool 40 so that when the piercing tool 40 is employed in the apparatus illustrated in Fig. 6 to form holes on a flat, planar embossing member or plate disposed parallel with respect to the face 40*a* of the piercing tool 40 only a portion of the piercing members 41 carried by the piercing tool 40 initially contact and penetrate the embossing plate, the other piercing members subsequently contacting and penetrating the plate. Substantially the same results can be achieved by employing the piercing tool 22 and members 24 of Fig. 6 if the plate is not disposed parallel to the ends 24*a* of members 24.

The same results are also achieved by employing the piercing tool 50 shown in Fig. 8 wherein the piercing tool 50 is provided with piercing members 51, the sharpened ends of which all do not lie in the same plane and wherein, as illustrated, a portion of the ends 51*a* lie in one plane and other portion 51*b* lie in another plane inclined with respect to the first mentioned plane of ends 51*a*, the ends 51*a* and 51*b* defining an angular or wedge shape piercing tool.

In the practice of this invention, particularly in connection with the manufacture of

bossing tool for providing special finishes on plastics material surfaces, such method comprising moving relatively to the surface of the body adapted to form the embossing tool a piercing tool provided with a plurality of needle-like piercing members so that the surface of the body is pierced by said members, the positioning of the said surface of the embossing tool relatively to said piercing tool and the arrangement of the piercing members being such that, upon contact of the surface with the piercing tool, only some of the piercing members therein initially pierce the surface, the remainder of the piercing members subsequently piercing the surface, whereby the body is pierced more deeply at those locations on the surface of the body wherein the piercing members first contact said surface and less deeply at those locations on such surface which subsequently come into contact with piercing members.

14. A method according to Claim 13, wherein the surface of said body is cylindrical.

15. A method according to Claim 13, wherein the surface of said body is planar.

16. A method according to Claim 13, 14 or 15, wherein the piercing ends of said needle-like members lie in a single plane.

17. A method according to Claim 13, 14 or 15, wherein the piercing ends of said needle-like members are arranged in a wedge formation.

18. A method according to any one of Claims 13 to 17, wherein said body is formed of a relatively soft lead-containing alloy.

19. A method according to Claim 18, wherein said alloy comprises a major amount of lead and a minor amount of another metallic element.

20. A method according to Claim 19, wherein said other metallic element is antimony.

21. A method according to any one of Claims 13 to 20, wherein each of said needle-like piercing members is formed from a length of piano wire drawn to a point and sharpened at one end.

22. An embossing tool comprising a relatively soft metallic body having a surface pierced by holes extending only part of the way downwardly from said surface into said body, such holes being provided on said surface in a density in the range from about 200 to about 37,500 per square inch and having a depth in the range from about 0.002 to about 0.5 inch and an equivalent diameter at the said surface in the range from about 0.002 to about 0.2 inch.

23. Apparatus for use in the production of an embossing tool substantially as hereinbefore described with reference to and as shown by Figures 6 to 8 of the accompanying drawings.

24. A method of producing a pierced embossing tool substantially as hereinbefore described with reference to Figures 5 to 8 of the accompanying drawings.

25. An embossing tool formed using the apparatus of any one of Claims 1 to 12 or Claim 23 or by the method of any one of Claims 13 to 21 or Claim 24.

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919100 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 1 & 2

Fig. 5.

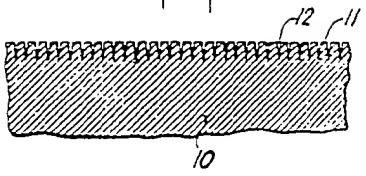

Fig. 6.

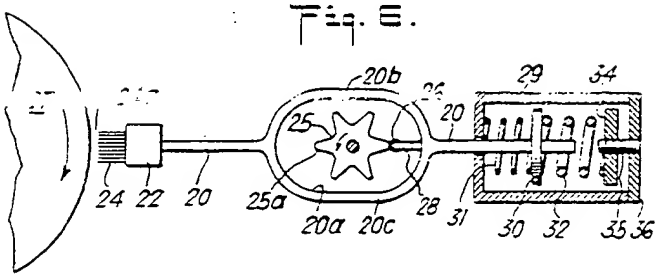

Fig. 7.

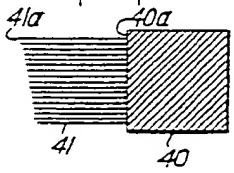

Fig. 8.